Determination of Haematocrit Using the SMA4

We were interested to read the letter from Drs Lappin and Lamont (1968) describing the effect of EDTA on the haematocrit as estimated by the electrical conductance method using the SMA4 machine.

In our early trials of the SMA4, the haematocrit line gave the most trouble. We found that with the strict quality control procedure already in use in the laboratory, the haemoglobin, white cell count, and red cell count results were acceptable for routine use. Each morning 15 ml of blood is taken from an outpatient into EDTA and assayed for haemoglobin using the cyanmethaemoglobin method which is standardized with the International Standard. The white cell and red cell counts are estimated by electronic particle counting and the haematocrit by microcentrifugation. This blood is used to standardize and to phase the SMA4 and inserted as every twentieth sample throughout the day.

It soon became apparent that the haematocrit line gave a small percentage of erratic results. As the effect of excess EDTA on the centrifuged haematocrit has been demonstrated (Lampasso, 1965), we discard all inadequately filled specimen bottles.

Several other factors are peculiar in affecting the electrical conductance method. Kernen, Wurzel, and Okada (1961), in the original evaluation of the method, emphasized that blood conductance is sensitive to temperature variation and regarded the inclusion of a thermistor in the circuit as essential. As no thermistor is included in the SMA4 we maintain ambient temperature as constant as possible.

Kernen et al. (1961) also showed that the calibration is not linear. To achieve maximal linearity we standardize the SMA4 machine with two potassium chloride solutions, 5-07 and 2-66 g/l, equivalent to haematocrits of 19% and 50% respectively. Even so, discrepancies still occur outside the range 15-55%.

Davis, Bresland, and Green (1966) and Kernen et al. (1961) drew attention to the effect of high plasma protein levels (exceeding 7 g/100 ml). In one week we found that 41 protein estimations 15 were abnormal but only one was a high value, the rest being low. In practice we have found the high protein levels in multiple myelomatosis and macroglobulinaemia to increase the haematocrit reading. The same authors showed the effect of alterations in sodium concentration. Again, in one week, of 166 sodium estimations we found 7% outside the normal range but there was no clear correlation between these abnormal levels and haematocrit errors.

Finally, it is known that a high white cell count will affect the blood conductance.

It thus became clear that erroneous haematocrit estimations due to these several factors might occur randomly and that the sum of the effects on any one estimation would be difficult to predict. It is possible to check any abnormal haematocrit result by repeating the examination using a centrifuge method. This is not very useful as the change in the electrical conductance caused by any of the factors mentioned may well have put an abnormal haematocrit into the normal range and it would not be recognized as one to be checked.

In this laboratory a blood film is examined routinely on all specimens. Our final procedure has therefore been to re-estimate the haematocrit on all specimens where the MCHC calculated from SMA4 data does not agree with the appearances on the film. In one recent sample of 557 consecutive specimens 19 discrepancies (3-4%) were found. Of these all but one (a haemoglobin error) were haematocrit errors.

We are of the opinion that the estimation of the haematocrit on the SMA4 is not yet a reliable procedure and a film should be examined as a check in all cases.

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REFERENCES


Book reviews


Dr Walter Seegers has sometimes been regarded as a difficult writer by workers not trained in his methods or conversant with his terminology. In this book he offers a concise and systematic account of his views and of the results of much of the work of his laboratory, for which haematologists interested in blood coagulation may be very grateful.

Chapter 1 contains a glossary of a dozen of the terms used by his group and a discussion of the physicochemical properties of prothrombin and thrombin, and of auto-prothrombin C, which Seegers equates with the active factor X of other authors, its precursor autoprothrombin III, and prothrombin, the precursor of thrombin. Chapter II presents Dr Seegers’ concept of haemostasis which of course includes his view of blood coagulation in which the reactions of the prothrombin molecule occupy a central position. Chapter III describes various reactions in which prothrombin may be involved, leading to the generation of thrombin and other activities; chapter IV considers the special case of the development of thrombin...
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J Clin Pathol 1968 21: 533
doi: 10.1136/jcp.21.4.533-a

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